

Serial No. 10/535,561  
Reply to Office Action of April 3, 2006

### **REMARKS/ARGUMENTS**

Prior to this Amendment, claims 1-33 were pending in the application.

Claim 1 is amended to include the limitations of originally-filed dependent claim 2, which is cancelled. Claim 3 is amended to correct its dependency. Claims 9 and 16 are amended to address objections of the Examiner. Claim 25 is amended to correct a typographical error.

After entry of the Amendment, claims 1 and 3-33 remain for consideration by the Examiner.

### **Oath/Declaration**

In the Office Action, the Declaration was objected to as being defective. A replacement and/or supplement Declaration is provided with this Amendment.

### **Priority**

Also, in the Office Action, the Examiner noted that U.S. Prov. Appl. No. 60/503,335 should not be the base priority document. Applicant has taken appropriate steps as suggested by the Examiner to correct this typographical error and claim priority to U.S. Prov. Appl. No. 60/503,336, which was filed September 16, 2003. The Petition to Accept an Unintentionally Delayed Claim and related documents are provided with this Amendment.

### **Claim Rejections Under 35 U.S.C. §112**

In the Office Action, claims 9 and 16 were rejected as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention. These claims are amended to provide proper antecedent basis and to more clearly define a claimed chemical compound.

### **Claim Rejections under 35 U.S.C. §102**

Also, in the Office Action, claims 1, 4-6, and 10 were rejected under 35 U.S.C. §102(b) as being anticipated by 2002/0157702 ("Cordaro"). This rejection is traversed based on the following remarks.

Claim 1 is directed to a method of fabricating a bi-layer photovoltaic cell that includes mixing p-type nanocrystalline semiconductors in a first binder and n-type nanocrystalline semiconductors in a second binder. Thin layers are formed of these mixtures and the p-type layer and n-type layer are bound to form a p-n heterojunction

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between the bound layers. As amended, claim 1 states "the p-type mixing further comprises mixing in a plurality of anion additives and wherein the n-type mixing further comprises mixing in a plurality of cation additives, whereby during the binding uncompensated anions are produced proximal to the interface in the p-layer and uncompensated cations are produced proximal to the interface in the n-layer." At least this limitation from cancelled claim 2 is not shown or suggested by Cordaro, and Applicant requests that the rejection be withdrawn.

Specifically, the Office Action rejects claim 2 as being obvious in light of Cordaro by arguing that the "filler particles" (elements 42 and 48) teach the mixing of anion and cation additives as called for in the claim (now claim 1). The Office Action states these filler particles can be "electrically conductive" and cites paragraph [0035] of Cordaro. However, the Office Action states that "Cordaro does not specifically teach that its conductive filler particles (42) and conductive filler particles (48) are anions and cations." The Examiner asserts the fact that they may be electrically conductive would lead someone to use anions and cations as called for in the claim "so that a working solar cell could be prepared." Applicant strongly disagrees with this construction of Cordaro.

First, at the cited paragraph [0035], the filler particles are not described as being "electrically conductive." The filler particles are instead taught to be "present to modify the bulk and flow consistency of the second paint layer structure 26" and may be  $\text{SiO}_2$  and  $\text{Al}_2\text{O}_3$ .

Second, even if the filler particles were taught to be conductive (rather than the resistive examples provided), Cordaro fails to show mixing in cation additives to the n-type nanocrystalline semiconductors and anion additives to the p-type nanocrystalline semiconductors. Prior to Applicants, there was no teaching of such use of anions and cation additives to create an internal electric field at or near the heterojunction so as to control recombination, with such a field called for in claim 1 with "whereby during the binding uncompensated anions are produced proximal to the interface in the p-layer and uncompensated cations are produced proximal to the interface in the n-layer." An addition of electrically conductive materials to both layers would not teach the claimed mixing of cation and anion additives to specific layers to produce the desired uncompensated anions and cations proximate to the heterojunction layer. As a result, Cordaro fails to teach the mixing steps of claim 1.

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Its teaching also fails to suggest such mixing, with the only motivation to modify Cordaro coming from Applicant's application. For example, at page 10, lines 8-11, Applicant states it is useful "that the materials selected for the charge additives be such that positive charges or positively charged ions are produced in the n-layer near the interface and negative charges or negatively charged ions are produced in the p-layer near the interface so as to produce the desired electric field or dipole to control recombination."

Such results would not be achieved by merely adding conductors. For these reasons, claim 1 is believed allowable over the teaching of Cordaro.

Claims 4-6 and 10 depend from claim 1 and are believed allowable over Cordaro for at least the reasons provided for allowing claim 1. Further, claim 4 calls for the binder to be an epoxy and for the binding step to be performed prior to curing of the epoxy of the two layers. The Office Action fails to provide a specific citation to Cordaro for teaching this limitation. In paragraph [0025], Cordaro teaches applying the two layers "in the manner of two coats of paint applied one over the other." As with standard painting, this teaches allowing the first coat or layer to dry or cure. Hence, Cordaro fails to teach the method of claim 4. Claim 5 calls for binding to include applying heat and pressure. Again, no citation to Cordaro was provided in the Office Action, and so, a prima facie case has not been stated for claims 4 and 5, and Applicant could find no teaching of applying heat and pressure (e.g., painting would not include applying pressure).

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**Claim Rejections under 35 U.S.C. §103**

Further, in the Office Action, claims 1-7, 10-12, and 14-16 were rejected under 35 U.S.C. §103(a) as being unpatentable over Cordaro. This rejection is traversed based on the following remarks.

Claim 1 is believed allowable over Cordaro for the reasons discussed above with reference to the anticipation rejection based on Cordaro. As discussed above, Cordaro fails to teach the use of anion and cation additives as called for in the mixing steps. There is no motivation to modify Cordaro's teaching to achieve the claimed method. The Examiner states that this would be obvious to one skilled in the art to create a working solar cell, but a "working" solar cell does not require the addition of such anion and cation additives and without Applicant's disclosure there is no teaching of the use of such additives to create a local electrical field at the heterojunction interface to control recombination and significantly increase efficiency. Hence, claim 1 is not obvious in light of the teaching of Cordaro.

Claims 3-7 and 10 depend from claim 1 and are believed allowable as depending from an allowable base claim. Additionally, claims 4 and 5 are believed allowable over Cordaro for the reasons provided above. No prima facie case of obviousness has been stated by the Examiner.

Independent claim 11 calls for a first semiconductor layer with nanocrystals of an n-type semiconductor and "a plurality of spatially bound cations." A second semiconductor layer is provided in the PV cell that includes nanocrystals of a p-type semiconductor and "a plurality of spatially bound anions." A p-n heterojunction is provided and "the spatially bound cations and anions are proximal to the p-n heterojunction." As discussed with reference to claim 1, Cordaro fails to show a PV cell that includes cations and anion additives proximal to a p-n heterojunction, and, hence, the reasons provided for allowing claim 1 over Cordaro are applicable to claim 11. Further, there is no discussion or suggestion in Cordaro that its filler particles are "spatially bound" cations or anions. Yet further, Cordaro fails to teach providing differing particles in each layer, i.e., the cations and anions are provided in differing layers (which are the n-type layer and p-type layer, respectively) but simply teaches use of fillers in both layers. For these reasons, the PV cell of claim 11 is not taught or suggested by Cordaro.

Claims 12 and 14-16 depend from claim 11 and are believed allowable at least for the reasons provided for allowing claim 11.

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Still further, the Office Action rejected claims 8, 9, 13, and 17-33 under 35 U.S.C. §103(a) as being unpatentable over Cordaro as applied to claims 1-7, 10-12, and 14-16 and further in view of JP 2003-332600 ("JP '600"). This rejection is traversed based on the following remarks.

Claims 8 and 9 depend from claim 1 and claim 13 depends from claim 11, and these claims are believed allowable over Cordaro for the reasons provided with reference to claims 1 and 11. Similarly, independent claim 17 includes limitations similar to that of claims 1 and 11 in that anion and cation additives are provided in the p-layer and n-layer, respectively. Hence, the reasons for allowing claims 1 and 11 over Cordaro are believed applicable to claim 17. Claims 18-33 depend from claim 17 and are believed allowable over Cordaro at least for the reasons for allowing claim 17.

Further, JP '600 is not cited as overcoming this deficiency in Cordaro but instead for its discussion of organic semiconductor particles in solar cells. As a result, the combination of Cordaro and JP '600 fail to teach or suggest the teaching of independent claims 1, 11, and 17 or dependent claims 8, 9, 13, and 18-33.

Yet further, the priority data for the application indicates a claim priority to U.S. Provisional Application 60/503,335, but, as noted by the Examiner, this application is the incorrect application. Applicant is taking the appropriate steps to correct the provisional application serial number to "60/503/336." The priority date, however, of September 16, 2003 is correct for the 60/503,336 application, and Applicant's application claims (or will be properly corrected to address this typographical or minor clerical error) to this provisional application. Because JP '600 can be used as a reference as of November 2003 rather than prior to September 16, 2003, this reference is not a proper 103(a) reference. Applicant requests that the rejections based on this reference be withdrawn, and claims 8, 9, 13, and 17-33 be allowed.

Also, the Office Action rejected claims 8, 9, 13, and 17-33 under 35 U.S.C. §103(a) as being unpatentable over Cordaro as applied to claims 1-7, 10-12, and 14-16 and further in view of U.S. Pat. No. 6,352,777 ("Bulovic"). This rejection is traversed based on the following remarks.

Claims 8 and 9 depend from claim 1 and claim 13 depends from claim 11, and these claims are believed allowable over Cordaro for the reasons provided with reference to claims 1 and 11. Similarly, independent claim 17 includes limitations similar to that of claims 1 and 11 in that anion and cation additives are provided in the p-layer and n-layer,

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respectively. Hence, the reasons for allowing claims 1 and 11 over Cordaro are believed applicable to claim 17. Claims 18-33 depend from claim 17 and are believed allowable over Cordaro at least for the reasons for allowing claim 17.

Further, Bulovic is not cited as overcoming this deficiency in Cordaro but instead for its discussion of TiOPc and PPyEI as organic semiconductor pairs. As a result, the combination of Cordaro and Bulovic fails to teach or suggest the teachings of independent claims 1, 11, and 17.

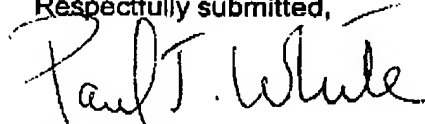
The Office Action also fails to state a prima facie case of obviousness for dependent claim 18, which calls for the anion and cation additives to be provided as first and second salts that are substantially dispersed in the p and n-layers or no discussion of using salt as fillers was shown in Cordaro or Bulovic. Claim 19 builds on claim 18 by specifying particular salts, and there is no citation provided to Cordaro or Bulovic of these claimed salts as additives. A prima facie case is also not stated for claims 21, 22, and 23, which are addressing the removal of byproducts of the binding process from the p-n heterojunction. Hence, Applicant requests that a specific prior art reference be provided for teaching each of the additional limitations of claims 18, 19, 21, 22, and 23 or that these rejections be withdrawn.

### Conclusions

In view of all of the above, it is requested that a Notice of Allowance be issued in this case.

No fee is believed due for this submittal. However, any fee deficiency associated with this submittal may be charged to Deposit Account No. 14-0460.

Respectfully submitted,



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Attachments